

M/V Selendang Ayu Oil Spill Fisheries Water Quality Sampling Program

Summary of Results



May 2005

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Executive Summary

On December 20, 2004 the Alaska Department of Environmental Conservation (ADEC) established a work group to address the risk to commercial fisheries posed by the December 8, 2004 grounding of the shipping vessel *M/V Selendang Ayu* near Unalaska Island, Alaska, and the resulting spill of intermediate fuel oil (IFO) and marine diesel oil (MDO). The Fisheries Work Group consisted of state and federal fisheries management agencies; experts in environmental health, fisheries biology, and oceanography; and representatives of local government, seafood processing plants, and fish marketing organizations. At the direction of the work group and ADEC, a fisheries water quality sampling program was implemented to monitor water and seafood quality in areas where commercial fishing, processing, and fishing vessel transits occur and to facilitate decision making by fishery managers.

The fisheries water quality sampling program ran from December 25, 2004 to March 24, 2005. Sampling was conducted in Unalaska Bay and in state and federal waters surrounding Unalaska Island and Akutan Island. The program was implemented as part of the State of Alaska's "zero tolerance" policy, which aims to prevent contaminated fin fish and shellfish species from reaching the consumer when an oil spill occurs. Nationally accepted standards for sampling protocols and seafood safety inspections were followed throughout the program. At-risk fisheries underway during the sampling program period included two crab fisheries and several economically significant ground fisheries, including Pollock, Pacific cod, and halibut.

Water quality sampling was conducted using a variety of sampling methods and materials. The program was established and implemented under tight time constraints in order to provide real time data regarding potential oil contamination in areas where commercial fishing, fish processing, and fishing vessel transits occur. Tasking was recommended by the Fisheries Work Group, approved by the Unified Command, and specifically linked to the imminent fishery risks posed by the spill incident. Results were presented daily to the Unified Command, reported periodically at public meetings, and posted on the Unified Command website.

The information collected through the program and presented in this report was done so for the purpose of facilitating real time decision making. The sampling methods and equipment used to support this program were developed or adapted to address the changing information needs of fishery managers and the Unified Command. Because this process was so dynamic, there was little opportunity during the program to synthesize data.

This report consolidates and synthesizes the data collected during the *M/V Selendang Ayu* fisheries water quality sampling program. Raw data from the fisheries water quality sampling program is presented in map and table form, with interpretive text to illuminate the results maps. The report does not attempt to draw any conclusions about the extent of oiling from the *M/V Selendang Ayu* incident or its impacts to the Aleutian Islands or Bering Sea fisheries.

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M/V Selendang Ayu Oil Spill Fisheries Water Quality Sampling Program

Summary of Results

May 2005

Introduction

Overview of Water Quality Sampling Program

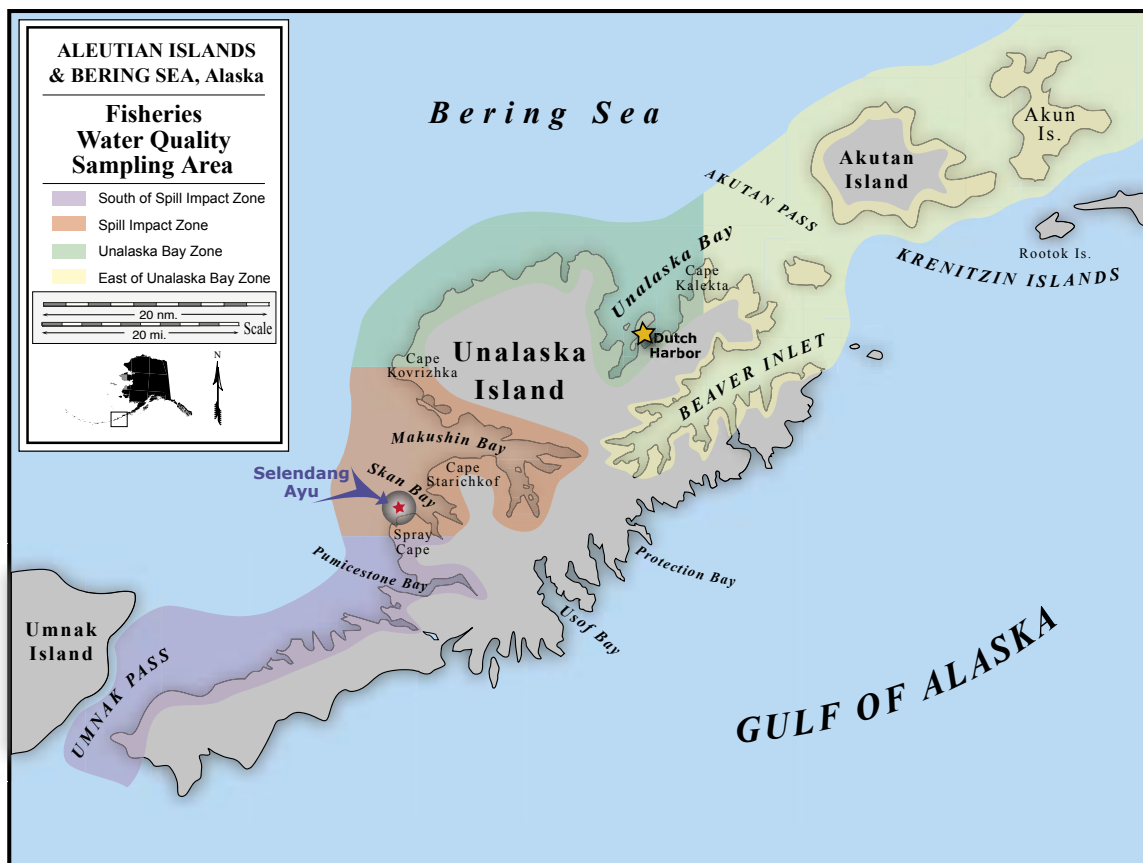
On December 8, 2004 the shipping vessel *M/V Selendang Ayu* ran aground and broke apart between Skan Bay and Spray Cape on Unalaska Island, in Alaska's Aleutian Islands. The vessel was carrying approximately 446,280 gallons of Intermediate Fuel Oil 380 (IFO) and 21,058 gallons of Marine Diesel Oil (MDO).

On December 20, 2004 the Alaska Department of Environmental Conservation (ADEC) established a work group to consider issues associated with the fisheries at risk of contamination by the spill. The primary risk of contamination was through whole oil in the form of tar balls in the water column or on benthic sediments. The Fisheries Work Group consisted of state and federal fisheries management agencies; experts in environmental health, fisheries biology, and oceanography; and representatives of local government and seafood processing and marketing organizations. At the time, Tanner crab (*Chionoecetes bairdi*) and snow crab (*Chionoecetes opilio*) fisheries were commencing, and the ground fisheries of Alaska pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), and halibut (*Hippoglossus stenolepis*) were gearing up (Nuka Research, 2005). At the direction of the Work Group and ADEC, a fisheries water quality sampling program was implemented to monitor water and seafood quality in areas where commercial fishing, processing, and fishing vessel transits occur and to facilitate decision making by fishery managers.

The fisheries water quality sampling program ran from December 25, 2004 to March 24, 2005. Sampling was conducted within Unalaska Bay, in the spill impact zone southwest of Unalaska Bay, and to the east of Unalaska Bay in Akutan Pass and Beaver Inlet (Figure 1).

This sampling was conducted using a variety of sampling methods and materials. Tasking was recommended by the Fisheries Work Group, approved by the Unified Command (UC), and specifically linked to the imminent fishery risks posed by the spill incident. Results were presented daily to the Unified Command, reported periodically at public meetings, and posted on the Unified Command website.

Figure 1: Fisheries Water Quality Sampling Area



Seafood Safety Considerations

The *Selendang Ayu* Fisheries Water Quality Sampling Program was implemented as part of the State of Alaska's "zero tolerance" policy, which aims to ensure that, when an oil spill occurs, contaminated fin fish and shellfish species do not reach the consumer (18 AAC 34 Article 6). Published references on oil spill water quality sampling and seafood safety were consulted and made available to members of the Fisheries Work Group and the Unified Command to support the sampling program. A National Oceanic and Atmospheric Administration (NOAA) publication regarding seafood safety after an oil spill provided a foundation for the sampling plans and protocols developed during this program (Yender, Michel and Lord, 2002). Established guidelines were followed for organoleptic (sensory) testing of fish species for oil contamination (Reilly and York, 2001).

Purpose and Scope of Report

This report has been prepared for the Alaska Department of Environmental Conservation by Nuka Research and Planning Group, LLC, to satisfy the contractual requirements under NTP #18-8003-28-08. This report consolidates the data collected during the *M/V Selendang Ayu* fisheries water quality sampling program. Although maps and data tables were presented throughout the duration

of the sampling program, it was done *ad hoc* and with little vision of future reference or memorandum. This report compiles the data gathered to provide a more coherent and comprehensive record of the project.

Raw data from the fisheries water quality sampling program is presented in map and table form, with interpretive text to illuminate the results maps. The report does not attempt to draw any conclusions about the *M/V Selendang Ayu* incident and its impacts to the Aleutian Islands or Bering Sea fisheries.

Methodology

This section describes the methods and materials used in the *M/V Selendang Ayu* fisheries water quality sampling program. This information is presented as a general overview to help the reader to interpret the results presented in subsequent sections of this report.

Sampling Program Organization

The water quality sampling program was run by the Sampling Group Supervisor, who operated within the Environmental Unit of the Incident Command System (ICS) (Figure 2). The Sampling Group consisted of Sampling Technicians, assigned either to a vessel, a beach team, or to the command post. The number of technicians varied during the course of the program. For each ICS operational period, the Sampling Group Supervisor developed a Sampling Plan, which was then vetted through the Environmental Unit, Fisheries Work Group, and the Unified Command. Upon approval of the plan, the Sampling Group Supervisor would then task the technicians and vessels to execute the plan. Results were relayed to the Sampling Group Supervisor daily for compilation and analysis.

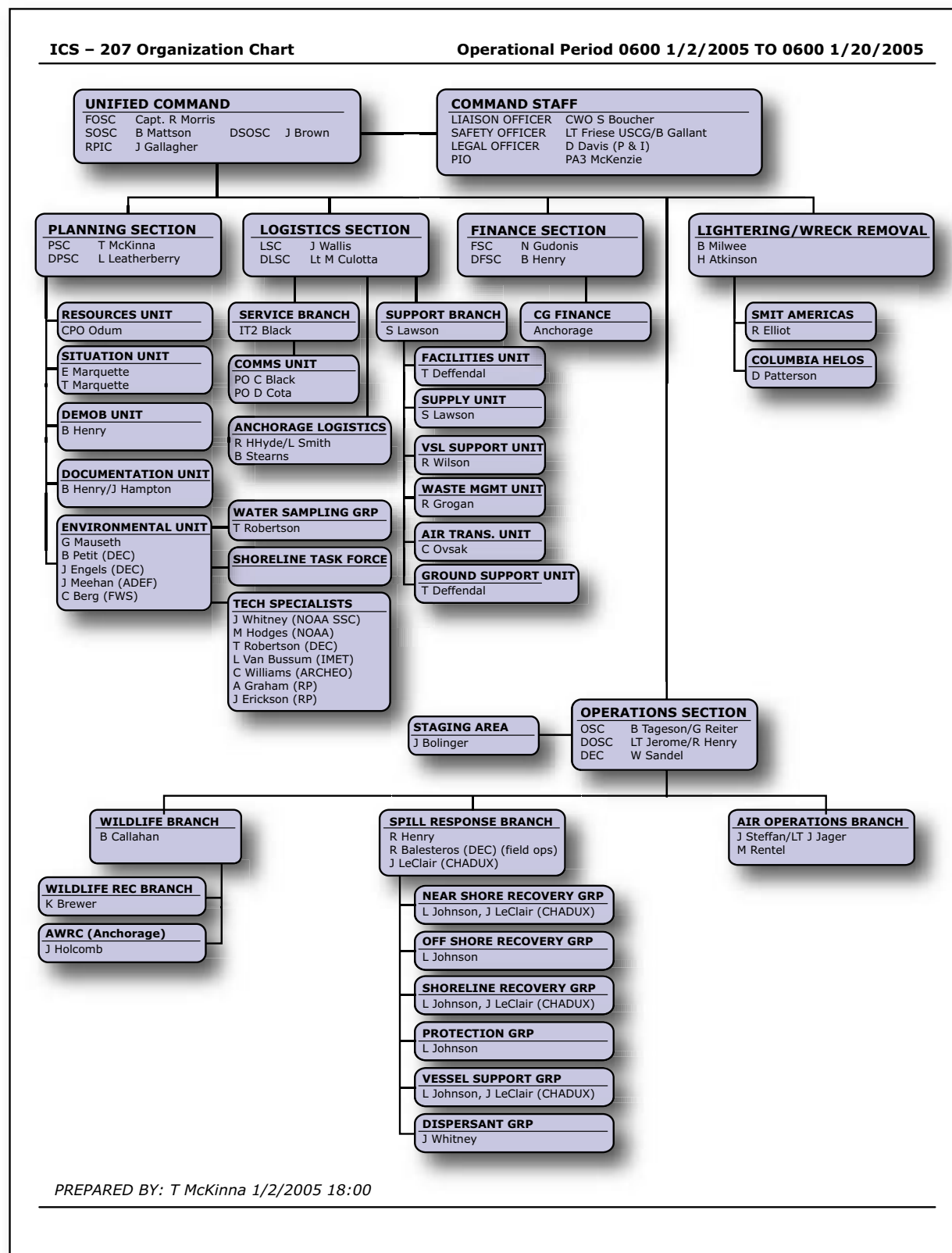
Sampling Methods and Equipment

TOW NETS

Tow net sampling was conducted initially using a single tow net, and later using two tow nets at varying water depths. The conical tow nets were 3 feet in diameter by 10 feet long and made with Phifertex®, which is a vinyl-coated polyester yarn woven into an 11x17 strands per inch mesh that is 34% open, weighs 11 ounces per yard, and is heat set to ensure that the strands do not shift. Each net was affixed to a steel ring and tow bridle (Figure 3). The nets were used to conduct near-surface trawls for whole oil in the study areas, towed at depths ranging from 0-12 feet below the water surface.

During the initial phases of the fisheries sampling program, tow nets were deployed at a single depth, usually between 9-12 feet below the surface, to approximate the keel depth of the water intake on most commercial fishing vessels. The tow depth was supported by calculations from the Scientific Support Coordinator (SSC), predicting that tar balls would be most likely encountered in the upper water column. As the sampling program

Figure 2. ICS Organization Chart from Selendang Ayu Incident Action Plan, January 2005.



progressed, a two-net sampling protocol was introduced, where one net was deployed near the water surface (average depth of approximately 3 feet) and a second net was deployed slightly deeper (between 9-12 feet below the water surface). The purpose of the second net was to approximate the depth of the seawater intake on most fishing vessels.

The Sampling Group Supervisor selected sampling transects or areas within each sampling zone after consulting with the Unified Command and the Environmental Unit. Date, tow depth, starting and ending time and location (lat/long coordinates), and presence or absence of oil was recorded for each tow. Average tow time varied from thirty minutes to one hour, at speeds ranging from 1.5 to 4 knots. Nets were examined by sight and smell, using nitrile gloves on sorbent pads, for the presence of whole oil contamination. Suspect nets were further examined under ultra-violet (UV) light to confirm presence of oil. When possible, oil observed on the tow net was collected for possible laboratory analysis.

It was imperative to thoroughly decontaminate any oiled net for sampling accuracy. The net was scrubbed in diluted degreasing solution with a nylon brush, rinsed with clean seawater, and the process was repeated if necessary. This decontamination procedure was performed immediately after the observed oil was recorded, photographed, and sampled (if applicable), and also at the end of each sampling day to ensure a clean net for the next sampling period.

FISHERIES POTS

Baited commercial 7 foot by 7 foot crab pots were fitted with oleophilic snare on the four corners of the bottom of the pot, and at every fathom (6 feet) along the buoy line (Figure 3). These pots were used to assess the potential for oiling commercial pot gear, and to collect crab and groundfish for seafood safety inspections.

The Sampling Group Supervisor selected stations in each sampling zone after consulting with the Unified Command and the Environmental Unit. Crab pots were dropped on the seabed at the sampling stations and left for a period of 1-7 days, after which they were pulled from the seabed and examined by technicians for the presence of oil contamination on the oleophilic snare. Each snare was examined by sight and smell and suspect snares were examined by UV light to confirm the presence of oil. Crab and ground fish captured in the pot were examined by ADEC seafood inspectors for signs of oil contamination using UV light and organoleptic techniques. Pot release and retrieval date, time, location, species caught, and presence or absence of oil was recorded for each pot set. Results were reported to the Environmental Unit Leader and the Sampling Group Supervisor. Any oil found was collected for possible laboratory analysis.

SNARE POTS

Unbaited commercial crab pots were fitted with oleophilic snare on the four corners of the bottom of the pot, and at every fathom along the buoy line (Figure 3). These pots were used strictly to assess the potential for oiling commercial pot gear; no seafood was collected.

The Sampling Group Supervisor selected stations in each sampling zone after consulting with the Unified Command and the Environmental Unit. Crab pots were dropped on the seabed at the sampling stations and left for a period of 1-7 days, and then examined for the presence of oil contamination on the oleophilic snare. Each snare was examined by sight and smell and suspect snares were examined by UV light to confirm the presence of oil. Pot release and retrieval date, time, location, and presence or absence of oil was recorded for each pot set. Results were reported to the Environmental Unit Leader and the Sampling Group Supervisor. Any oil found was collected for possible laboratory analysis.

DISSOLVED PHASE OIL

Grab samples of seawater were taken using a Go-Flo® bottle (Figure 3) at pre-selected stations at two depths: approximately 10 feet below the water surface and approximately 16 feet above the seafloor. Each sample was split into two parts to allow for independent laboratory analyses by the state and the Responsible Party (RP).

The Sampling Group Supervisor selected stations after consulting with the Unified Command and the Environmental Unit. For each grab sample, the Sampling Technician recorded the location, date, time, depth, and sample identification number. Samples were split and the state's portion was sent to a laboratory for analysis of total petroleum hydrocarbons (TPH) to determine whether the water within the study area met the state's criteria for dissolved phase hydrocarbons. Results were reported to the Environmental Unit Leader and the Sampling Group Supervisor.

POLLOCK AND PACIFIC COD VESSEL POM-POM PACKS

Pillows constructed of fine mesh net (see specifications for tow nets) and filled with oleophilic snare, designed to be secured within circulating refrigerated sea water (RSW) tanks aboard vessels, were distributed to the pollock and Pacific cod fisheries fleets in order to assess oil contamination in fish holding tanks (Figure 3). Vessel captains were instructed to secure pom-pom packs near the top of the tanks prior to tanking down (filling tank with seawater), and remove them before loading catch into the tank. Participants were asked to examine snare by sight and smell for oil contamination, and report any suspect presence of oil to the Alaska Department of Fish and Game (ADFG), ADEC seafood inspectors, and the Unified Command.

SEAWATER STRAINERS

An oil trap in the seawater intake of the sampling vessels and one vessel of opportunity was used to monitor the water pumped through the sea chest (Figure 3). The trap was examined at regular intervals for the presence of oil. Field observations were reported to the Sampling Group Supervisor. Any oil found was collected for possible laboratory analysis.

SEAFOOD PROCESSORS SEAWATER INTAKES

Seawater straining baskets constructed of fine mesh material (see specifications for tow nets) and filled with oleophilic snare were placed under a continuous stream of seawater from the fish processing plants' intake systems in Unalaska Bay and on mobile fish processors operating in and near Unalaska (Figure 3). These baskets and snare were monitored daily for oil contamination. Field observations were reported to the Sampling Group Supervisor.

PASSIVE SNARE DEVICES

Twenty passive snare devices were constructed, consisting of an anchor, anchor line, and buoy, each fitted with oleophilic oil snare on the anchor and every 30 feet along the line to the buoy (Figure 3). The Sampling Group Supervisor selected sampling stations in Unalaska Bay after consulting with the Unified Command and the Environmental Unit. Sampling stations were placed in known convergence areas and areas where oil had been reported through previous sampling surveys. The passive snare devices were dropped on the seabed at the sampling stations, left for a period of ten days, and then examined for the presence of oil contamination on the oleophilic snare. Each snare was examined by sight, smell and UV light for the presence of oil. Results were reported to the Sampling Group Supervisor and the Unified Command. Any oil found was collected for possible laboratory analysis.

BEACH SURVEYS

Shoreline segments in five designated locations within Unalaska Bay were surveyed regularly by a team of two technicians for the presence of tar balls. All tar ball observations were logged (time, date, location, and size) and tar balls were collected for disposal (Figure 3). Each beach segment was approximately one mile in length, and the same segments were surveyed repeatedly to develop a data set that could be compared over time and used as an indicator of changes in the abundance of tar balls in Unalaska Bay. Shoreline segments were located in Wide Bay, Airport Beach, the Dutch Harbor spit, Summer Bay, Iliuliuk (Front) Bay, and Little South America (Figure 4).

Results were reported to the Sampling Group Supervisor and the Unified Command. Samples from tar balls found were collected for possible laboratory analysis.

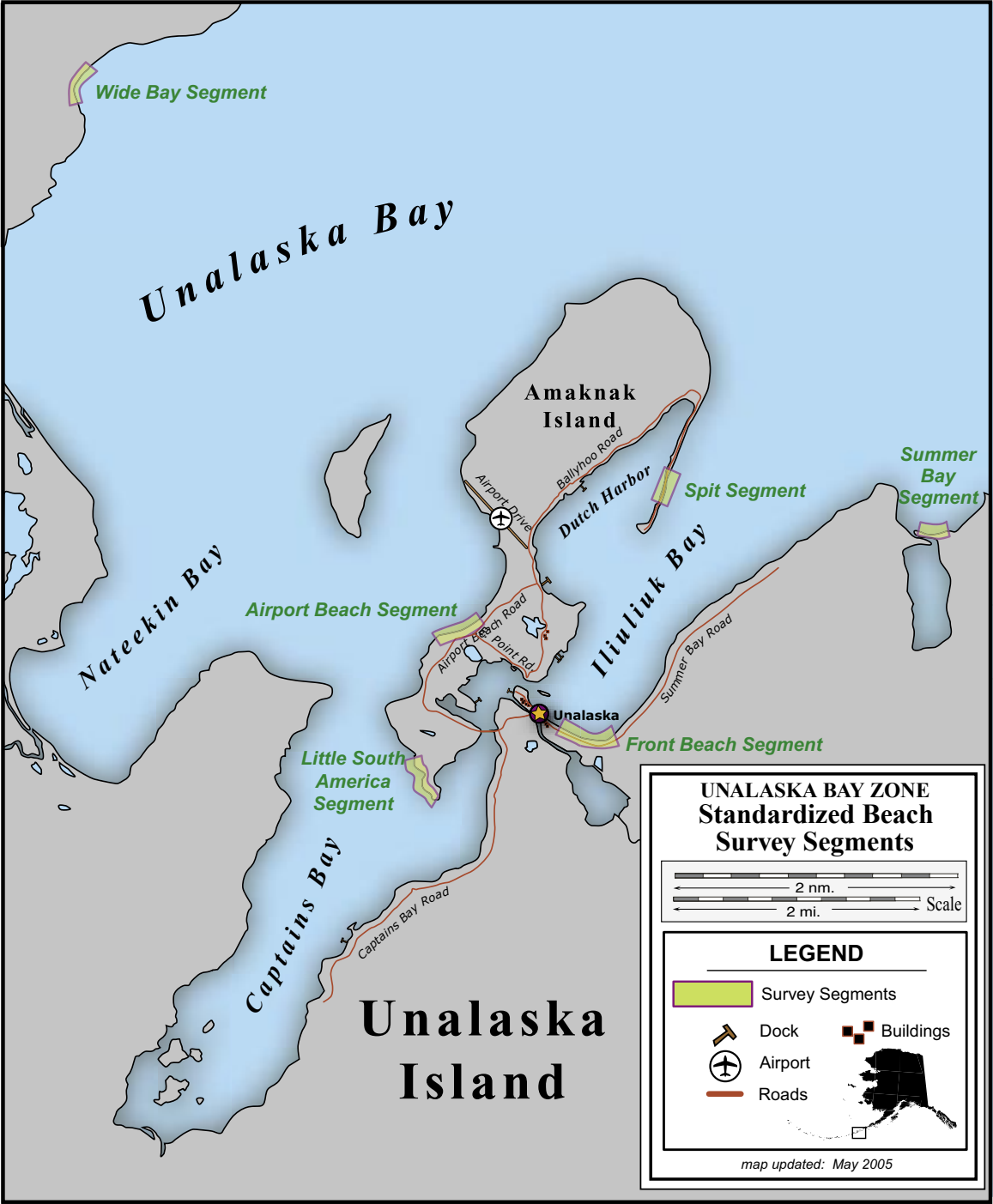
LONG LINES

Oleophilic oil snares were attached to a long line that was held on the sea-bed using anchors (Figure 3). Twenty skates of long line gear, each about 1,800 feet in length, were utilized to assess the potential for oiling of commercial long line gear. The long lines were retrieved after sitting on the bottom for one day. Each snare was examined by sight and smell and suspect snares were examined by UV light to confirm the presence of oil. Results were reported to the Sampling Group Supervisor and the Unified Command. Any oil found was collected for possible laboratory analysis.

Figure 3: Equipment used in Fisheries Water Quality Sampling Program.



Figure 4: Unalaska Bay Zone Beach Survey Segments.



Sampling Resources

Over the course of this sampling program, four contracted vessels were used as sampling platforms: the *F/V Alaskan Lady*, the *F/V Exito*, the *F/V Northern Fury*, and the *F/V Commitment*. One vessel of opportunity, the *F/V Sirene*, was also used for gathering seawater strainer observations. One or two sampling technicians were assigned to each vessel to record data and collect samples of any oil encountered. Sampling gear included 30 commercial crab pots, approximately 20 skates of long line, 6 tow nets, approximately 12 sea straining baskets, 200 pom-pom packs, and associated snare, sorbent, UV lights, nitrile gloves, and collection equipment.

Sample Handling

Observed oil was collected in a glass vial if the amount was sufficient, sealed, labeled, and stored in a secure area. Standard chain of custody protocol was observed for all samples. In addition to the chain of custody documentation, a log was kept of all samples obtained, and at the end of the program all samples were sent to SGS Laboratories in Anchorage, Alaska, for analysis.

Sampling Zones and Program Phases

For the purpose of data compilation and analysis, the spatial scope of the study area has been divided into four zones: Unalaska Bay Zone; Spill Impact Zone; South of Spill Impact Zone; and East of Unalaska Bay Zone (Figure 1).

The sampling program was also divided into phases to reflect changes in the information needs of the Unified Command and the Fisheries Work Group. Prior to the implementation of each program phase, a sampling plan was developed, outlining the duration, objectives, methodologies, and spatial scope (Figure 5). All sampling plans were vetted through the Fisheries Work Group and approved by the Unified Command.

For the purpose of this report, data has been presented by zone rather than by program phase; the following discussion addresses the chronology of sampling within each zone.

UNALASKA BAY ZONE

The sampling program focused heavily on the Unalaska Bay zone, because the majority of seafood processing plants are located within Unalaska Bay, and vessel traffic is concentrated in this area. The Unalaska Bay Sampling Zone includes both state and federal waters (out to 12 miles from shore) from Cape Kovrzhka to Cape Kalekta. Information collected in the Unalaska Bay zone was used to assess the risk to crab and ground fisheries that occurred in the bay and to monitor water quality for commercial seafood processing plants as well as transiting fishing vessels that use seawater in their fish holds. All five of the sampling vessels were involved in studies in Unalaska Bay, and with the exception of Phase 1, all phases of the program involved sampling in Unalaska Bay. Phase 2 water quality sampling focused

on potential impacts to the Unalaska Bay Tanner crab fishery. Phase 3 focused on the areas of Unalaska Bay that are the primary transit routes and anchorage areas for vessels in the Bering Sea snow crab fleet, as well as addressing the floating and shore-based processors in Unalaska Bay. Phase 4 began the transition into the winter sampling plan, which focused on monitoring the waters of Unalaska Bay. Phases 5 and 6 involved the continuation of winter monitoring in Unalaska Bay; during Phase 5, vessel-based sampling methods were concluded and in Phase 6, beach surveys became the primary methodology for Unalaska Bay sampling.

EAST OF UNALASKA BAY ZONE

The East of Unalaska Bay zone, which ranges east of Cape Kalekta and includes Akutan Bay and Beaver Inlet, was sampled concurrently with the Unalaska Bay zone during Phases 2 and 3 of the sampling program. The focus in the East zone, as in Unalaska Bay, was on assessing water quality for crab vessel transits and seafood processing. Because snow crab vessels use circulating seawater tanks to hold live crab onboard, water quality concerns existed along transit routes to and from Bering Sea fishing grounds, and in holding areas where vessels wait to deliver their catch to processing plants in Unalaska Bay, Dutch Harbor, and Akutan. Monitoring this zone was also crucial for the seafood processing plant on Akutan Island. During Phases 2 and 3, the *F/V Alaskan Lady* and the *F/V Exito* conducted tow net, fisheries pot, and sea strainer sampling studies in the East of Unalaska Bay zone.

SPILL IMPACT ZONE

The Spill Impact Zone, defined as state waters from Cape Kovrizhka to Spray Cape, was surveyed during Phases 1 and 5 of the sampling program. At the onset of the water quality sampling program, several fisheries were active or gearing up, which created a sense of urgency to determine whether areas adjacent to the grounding site should still be open for commercial fishing. Phase 1 sampling in the Spill Impact Zone initially used baited crab pots to assess seafood contamination as well as tow nets and sea strainer methods to monitor water quality near the wreck. Further sampling in this zone was conducted by the *F/V Alaskan Lady* during Phase 5 of the program using fisheries pots, tow nets, sea strainers and long line. The data collected was used to support the Unified Command's spill response decision making, ADEC designation of a threatened waterbody, and Fisheries Managers' opening/closure decision making for the Tanner crab, pollock, Pacific cod, and Pacific halibut commercial fisheries.

SOUTH OF SPILL IMPACT ZONE

The South of Spill Impact Zone was surveyed during Phase 4 of the fisheries water quality sampling program to address concerns regarding the extent of oiling in the areas south and west of the spill impact area, in particular the established fishing grounds in that area. During Phase 4, the *F/V Alaskan Lady* conducted tow net, fisheries pot, long line, and sea strainer sampling in state waters between Spray Cape and Umnak Pass.

Figure 5: Fisheries Water Quality Sampling Phases

Phase	Dates	Objectives	Methods	Zones	Fisheries Considerations
Phase 1	12/25/04 through 12/28/04	<ol style="list-style-type: none"> 1. Determine if there is surface, sub-surface, or benthic oil contamination near the wreck and in the areas where sheens and shoreline impacts have occurred. 2. Determine if Tanner crab in the <i>Makushin Bay</i> fishery area show any sign of oil contamination. 3. Determine if tar balls are present in the water column. 	<ul style="list-style-type: none"> • Fisheries pots • Sea strainers 	Spill Impact Zone	<ul style="list-style-type: none"> • Makushin Tanner (<i>bairdi</i>) crab fishery scheduled to open 1/15/05; closed by ADFG 12/27/04. <i>Potential ingestion, direct contact, or absorption of dissolved phase oil by species. Gear vulnerable to contamination.</i> • Inshore areas in Skan and Makushin Bays closed to state and federal ground fisheries (12/27/05) <i>Inshore fishery adjacent to oiled beaches and in area with known floating oil. Potential ingestion, direct contact, or absorption of dissolved phase oil by species. Gear vulnerable to contamination.</i> • Additional upcoming season openings with vessel traffic, processing, and fishing in Unalaska area.

Phase	Dates	Objectives	Methods	Zones	Fisheries Considerations
Phase 2	12/29/04 through 1/10/05	<ol style="list-style-type: none"> 1. Determine if there is detectable dissolved phase oil contamination in Unalaska Bay. 2. Determine if there is benthic oil contamination in Unalaska Bay and in the vicinity of Akutan Island. 3. Determine if Tanner crab in the Unalaska Bay fishery area show any sign of oil contamination. 4. Determine if tar balls are present in the Unalaska Bay water column and if so, determine the spatial extent and concentration of the contamination. 5. Determine if tar balls are present in the water column in the vicinity of Akutan Island and Unimak Pass. 6. Determine if tar balls are present in the salt water systems of processors in the Dutch Harbor/Unalaska area. 	<ul style="list-style-type: none"> • Tow nets • Fisheries pots • Dissolved phase oil • Seawater strainers • Seafood processors' seawater intakes 	<p>Unalaska Bay Zone</p> <p>East of Unalaska Bay Zone</p>	<ul style="list-style-type: none"> • Pacific cod pot/line fishery opens 1/1/05, but with little activity until later in January. <i>Potential ingestion, direct contact, or absorption of dissolved phase oil by species. Gear vulnerable to contamination. Potential for floating oil in Unalaska Bay to enter seawater intakes at processors and on vessels using re-circulating tanks.</i> • Unalaska Tanner crab and Bering Sea snow crab fisheries to open 1/15/05 with fishing, transit, and processing in Unalaska Bay.

Phase	Dates	Objectives	Methods	Zones	Fisheries Considerations
Phase 3	1/11/05 through 1/17/05	<ol style="list-style-type: none"> Determine the extent of tar ball contamination in the areas of Unalaska Bay, Akutan Pass, or other known transit areas utilized by the Bering Sea <i>opilio</i> fleet and in the Unalaska Bay Tanner crab fishery area. Determine if tar balls, tar patties, fresh oil, mousse, or other forms of whole oil are present in the salt water systems of processors in the Dutch Harbor/Unalaska area. Determine maximum distance from shore that spilled oil is present. 	<ul style="list-style-type: none"> Tow nets Fisheries pots Seawater strainers Seafood processors' seawater intakes Pollock pom-pom packs 	Unalaska Bay Zone East of Unalaska Bay Zone	<ul style="list-style-type: none"> Unalaska Tanner crab and Bering Sea <i>opilio</i> crab fisheries open 1/15/05. Oil identification advisory and protocol disseminated by UC to fishers and processors. <i>Potential ingestion, direct contact, or absorption of dissolved phase oil by species. Gear vulnerable to contamination. Potential for floating oil in Unalaska Bay to enter seawater intakes at processors and on vessels using re-circulating tanks.</i> State inspections finding no contamination of product are publicized to market.

Phase	Dates	Objectives	Methods	Zones	Fisheries Considerations
Phase 4	1/18/05 through 2/14/05	<ol style="list-style-type: none"> 1. Determine the extent of spilled oil in the areas of Unalaska Bay, Akutan Pass, or other known transit areas utilized by the Bering Sea snow fleet. 2. Determine if tar balls, tar patties, fresh oil, mousse, or other forms of whole oil are present in the salt water systems of processors in the Dutch Harbor/Unalaska area. 3. Determine maximum distance from shore that spilled oil is present. 4. Determine if spilled oil is present in areas of Unalaska Bay where the Bering sea snow crab fleet is anchored holding live crab and where the Pollock catcher boats take on water for their Refrigerated Sea Water (RSW) tanks. 5. Determine if spilled oil is present in the State waters between Spray Cape and Umnak Pass (south of spill zone). 	<ul style="list-style-type: none"> • Tow nets • Fisheries pots • Snare pots • Seawater strainers • Seafood processors' seawater intakes • Pollock and P. cod pom-pom packs • Passive snare devices • Long lines 	<p>Unalaska Bay East of Unalaska Bay South of Spill Impact Zone</p>	<ul style="list-style-type: none"> • Unalaska Tanner crab fishery closes 1/18/05, Bering Sea snow crab fishery closes 1/20/05. Potential for floating oil in Unalaska Bay to enter seawater intakes at processors and on vessels using re-circulating tanks as they await processing. • Pollock "A" season and Gulf of Alaska Pollock seasons open 1/20/05. <i>Potential for floating oil in Unalaska Bay to enter seawater intakes at processors and on vessels that tank down in Bay.</i> • Pacific cod trawl "A" season opened 1/20/05 (pot/line gear fishery picks up after <i>opilio</i> season and begins to close 2/12/05). <i>Potential ingestion, direct contact, or absorption of dissolved phase oil by species. Gear vulnerable to contamination. Potential for floating oil in Unalaska Bay to enter seawater intakes at processors and on vessels that tank down in Bay.</i> • Notice to Pollock and cod catcher boats issued by UC on 1/22/05, including oil identification techniques, devices, and protocols.

Phase	Dates	Objectives	Methods	Zones	Fisheries Considerations
Phase 5	2/15/05 through 2/23/05	<ol style="list-style-type: none"> 1. Monitor seawater intakes at Unalaska seafood processing plants for the presence of whole oil. 2. Monitor RSW tanks on pollock catcher boats for the presence of whole oil. 3. Monitor Unalaska Bay for presence of tar balls. 4. Determine if there is benthic oil contamination near the wreck and in the areas where sheens and shoreline impacts have occurred. 5. Determine if whole oil is present in the water column near the wreck and in the areas where sheens and shoreline impacts have occurred. 	<ul style="list-style-type: none"> • Tow nets • Fisheries pots • Seawater strainers • Seafood processors' seawater intakes • Passive snare devices • Long lines 	Unalaska Bay Spill Impact Zone	<ul style="list-style-type: none"> • Ongoing consideration for contamination at processors' saltwater intakes as Pollock, Pacific cod, crab, and other species are processed.

Phase	Dates	Objectives	Methods	Zones	Fisheries Considerations
Phase 6	2/24/05 through 3/24/05	<ol style="list-style-type: none"> 1. Monitor seawater intakes at Unalaska seafood processing plants for the presence of whole oil. 2. Monitor RSW tanks on Pollock catcher boats for the presence of whole oil. 3. Monitor Unalaska Bay for presence of tarballs. 4. Monitor beaches in Unalaska Bay for tarballs. 	<ul style="list-style-type: none"> • Tow nets • Seafood processors' seawater intakes • Passive snare devices • Beach surveys 	Unalaska Bay	<ul style="list-style-type: none"> • Pacific halibut IFQ and sablefish IFQ fisheries opened 2/27/05. • Inshore fishery is adjacent to oiled beaches and with known floating oil. Potential ingestion, direct contact, or absorption of dissolved phase oil by species. Gear vulnerable to contamination. Potential for floating oil in Unalaska Bay to enter seawater intakes at processors. • Notice to halibut boats issued 3/3/05 by IPHC. • Pacific cod (pot/line fishery) season closed 3/10/05. Pollock "A" season closed 3/25. <i>Potential for floating oil in Unalaska Bay to enter seawater intakes at processors.</i>

Data Compilation and Analysis

DATA KEEPING AND RESULTS MAPS

Data observed by sampling technicians aboard vessels and on shore were recorded in Rite-in-the-Rain field notebooks using standardized log formats, terminology, and units of measure. Separate logs were kept for each method of sampling. At the conclusion of each sampling trip, the data were transferred to electronic spreadsheets organized by vessel and further broken down by sampling method, and were backed up with a photocopy of the original logbook entries. The waypoints and tracks recorded by the technician on handheld global positioning system (GPS) units were downloaded to a chart plotting computer program, and from this program, a map was produced for each sampling method in a given sampling period and zone. The maps presented the results in terms of oil observations, using color-coded symbols for either evidence of oil or no evidence of oil.

During the spill response, maps were compiled and presented to the Unified Command at the conclusion of each sampling day or vessel trip. Results were also presented periodically at public meetings. All results maps generated and presented during the spill response were considered preliminary due to the quick turnaround from raw data to compiled map.

For this report, the vessel spreadsheets were combined and reorganized by zone so that each zone had a separate table for each sampling method. Each individual table was further broken down into sampling periods, according to fisheries water quality sampling program phase dates, fisheries opening and closing dates, and/or zonal activity. From the data collected during each sampling period, a map and a table were created for the purpose of this report. The maps and tables presented in this report are considered final and reflect a more deliberate compilation and expression of the program results.

TAR BALL TERMINOLOGY

During the course of the sampling program, three terms were used to describe the evidence of oil encounters on the tow net: tar ball, smear, and stain. Stain describes a spot of oil that fluoresces when observed under ultraviolet light on the net, but is too small to wipe off with a glove or to extract a sample. Smear describes oil that adheres to the tow net in sufficient quantity to wipe off with a glove but not enough oil to sample for lab analysis. Tar ball describes anything larger than a smear, of sufficient size to sample for lab analysis (Appendix S).

It is important to note that the difference between these three types of oil evidence does not necessarily relate to the total amount of oil encountered in the net, but may in fact have more to do with the length of retention in the tow net. For example, if a tar ball is encountered early in a 30-minute tow, by the time the net is pulled, all that remains as evidence of the encounter may be a smear or stain.

CATCH PER UNIT EFFORT ANALYSIS

The data tables generated during the spill response are included as Appendices to this report. The tow net data tables include a column labeled Catch per Unit Effort (CPUE), which expresses the oil encounter rate in terms of the number of oil encounters per total volume of water sampled each day. CPUE is most commonly used to estimate population sizes by fisheries and wildlife biologists, based on the assumption that the rate of removal per effort expended from a population will be proportional to the density or size of the population. Therefore the proportionate “yield” of oil encounters in the tow net may be seen as an indicator of the general “population” of tar balls in a water body.

In calculating CPUE for tar ball encounters, a challenge arose in how to count each stain, smear, and tar ball observed on the tow nets. Rather than attempt to calculate the actual volume of oil in each tarball, which would be nearly impossible because the tarballs are extruded through the net during the course of a tow, each oil observation was assigned a value of one, regardless of the size (smear, stain, or tarball). If three oil stains were observed on a net over the course of a tow, then the CPUE would be calculated by dividing three by the number of gallons of seawater sampled. The total volume of seawater sampled was calculated based on the surface area of the net, the length of time towed, and the speed at which it was towed through the water. CPUE is reported as tarballs per million gallons of water sampled (TPM). This provided a means for comparison over time to determine overall trends in oil encounter rates within a given area over time.